

Network Standard

NETWORK

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**NS210 DOCUMENTATION AND REFERENCE DESIGN GUIDE FOR
MAJOR SUBSTATIONS**



ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with the design of Ausgrid's major substations, and is for reference by field, technical and engineering staff.

Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document

DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid's Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

Notes: 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2011 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfil the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

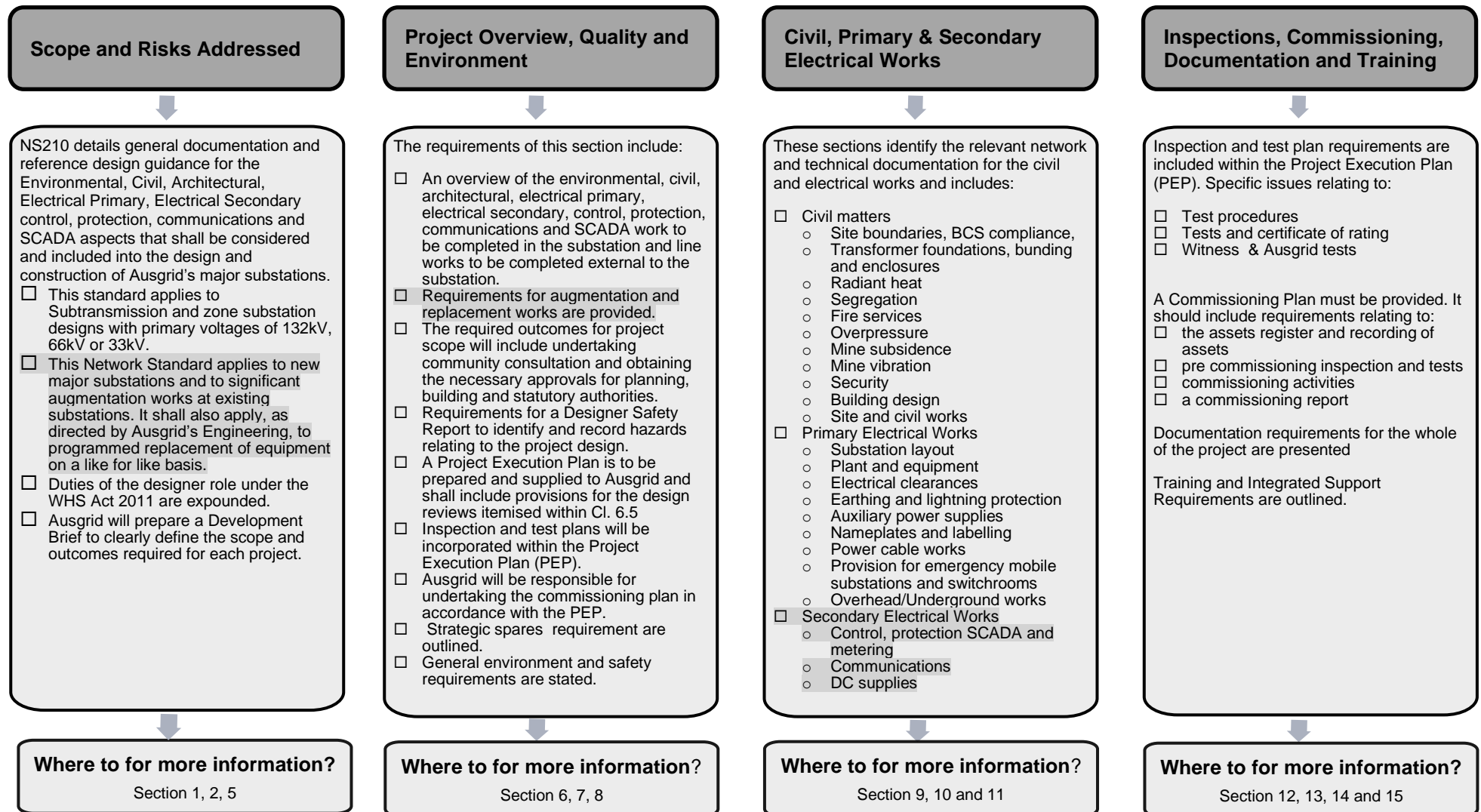
KEYPOINTS

This standard has a summary of content labelled "KEYPOINTS FOR THIS STANDARD". The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.").

KEY POINTS OF THIS STANDARD



Network Standard NS210 Documentation and Reference Design Guide for Major Substations

Contents

1.0	PURPOSE	7
2.0	SCOPE	8
3.0	REFERENCES	8
3.1	General.....	8
3.1.1	Standards	8
3.1.2	Ausgrid technical specifications	8
3.1.3	Industry codes and guidelines.....	8
3.1.4	Climatic service conditions	9
3.2	Ausgrid documents	9
3.3	Other standards and documents.....	11
3.4	Acts and regulations.....	12
4.0	DEFINITIONS	13
5.0	WORK HEALTH AND SAFETY ACT (NSW).....	14
6.0	PROJECT OVERVIEW.....	14
6.1	General.....	14
6.2	Augmentation and replacement works.....	14
6.2.1	General.....	14
6.2.2	Augmentation works - new bays	15
6.2.3	Augmentation works - existing bays.....	15
6.2.4	Replacement works – existing bays.....	15
6.3	Consultation and approvals	15
6.4	Alternative plant and equipment	15
6.5	Project execution plan.....	15
6.6	Strategic spares	16
7.0	QUALITY ASSURANCE	17
7.1	General.....	17
7.2	Quality of materials, equipment and workmanship	17
7.3	Quality in the absence of detailed specification.....	17
8.0	ENVIRONMENT AND SAFETY.....	17
8.1	Environmental Code of Conduct	17
8.2	Environmental Impact Assessment (EIA)	17
8.3	Electrical safety	17
8.4	Site contamination.....	17
8.5	Material safety aspects	18
8.6	EMF study.....	18
8.7	Electro-magnetic Fields (EMF)	18
8.8	Sound levels.....	18
8.9	Sustainable development.....	18
9.0	CIVIL AND BUILDING WORKS.....	19

9.1	Site investigations	19
9.2	Boundary clearances	19
9.3	BCA compliance.....	19
9.4	Transformer foundations, bunding and enclosures	19
9.5	Radiant heat.....	19
9.6	Segregation.....	20
9.7	Fire services	20
9.8	Overpressure	20
9.9	Mine subsidence	20
9.10	Mine vibration.....	20
9.11	Security	20
9.12	Substation building design	20
9.13	Site and civil works.....	20
10.0	PRIMARY ELECTRICAL WORKS.....	21
10.1	Substation layout.....	21
10.2	Plant and equipment	21
10.3	Electrical clearances	21
10.4	Earthing and lightning protection	21
10.5	Auxiliary power supplies.....	22
10.6	Nameplates and labelling.....	22
10.7	Power cable works	22
10.8	Provision for emergency mobile substations and switchrooms	22
10.9	11kV Works.....	22
	10.9.1 11kV overhead line works	22
	10.9.2 11kV underground cable works.....	22
10.10	33kV-132kV works	23
	10.10.1 33kV-132kV overhead line works	23
	10.10.2 33kV-132kV underground cable works.....	23
10.11	Other electrical works.....	23
11.0	SECONDARY SYSTEMS WORKS	23
11.1	Existing control & protection schemes and panels	23
11.2	Control, protection, SCADA and metering	23
11.3	Communications	23
11.4	DC supplies batteries and battery chargers.....	23
12.0	INSPECTION AND TESTING.....	24
12.1	General.....	24
12.2	Test procedures	24
12.3	Tests and Certificate of Rating.....	24
12.4	Witnessing tests and Ausgrid testing	24
13.0	COMMISSIONING	25
14.0	DOCUMENTATION AND DRAWINGS.....	25
14.1	General.....	25
14.2	Project documentation	25
	14.2.1 Protection settings.....	26
	14.2.2 Recording of protection settings.....	26
14.3	Civil & building maintenance and operation manual.....	26
14.4	Equipment manuals	27
14.5	Drawing standards	27
14.6	Ausgrid's engineering drawings	27

15.0 TRAINING 28

16.0 RECORDKEEPING 28

17.0 AUTHORITIES AND RESPONSIBILITIES 28

18.0 DOCUMENT CONTROL..... 28

ANNEXURE A –SAMPLE COMPLIANCE CHECKLIST 29

1.0 PURPOSE

To minimise project costs, without a reduction in quality, standardisation shall be employed in the following areas to reduce design, procurement and construction effort:

- switchyard layouts;
- buildings, building layouts and services;
- earthing;
- structures and footings;
- electrical plant and equipment; and
- control, protection, communications and SCADA.

To facilitate this standardisation, Ausgrid has developed this Network Standard. This Network Standard is supported by a set of integrated Network Standards and Technical Specifications that shall be used as the basis for all green field substation projects, and for significant augmentation at existing brown field substations.

These referenced Network Standards and Technical Specifications shall be supported by a separate Development Brief prepared by Ausgrid for each particular project defining the scope, objectives and delivery strategies. Major substations shall be designed to meet the technical requirements defined by Ausgrid including, but not limited to, the following areas;

- development stages;
- single line diagram;
- plant data; and
- protection and control schemes.

All work shall meet the requirements of the various Standards specified in this Network Standard and all plant and equipment shall comply with Ausgrid's Technical Specifications. However, this Network Standard should not constrain the approved development and implementation of new or alternative designs and technologies where appropriate.

As part of the Ausgrid continuous improvement process, post-implementation reviews shall be carried out on all major projects with the view of achieving best practice in major substation design, construction, operation and maintenance.

2.0 SCOPE

This Network Standard applies to new major substations and to significant augmentation works at existing substations. It shall also apply, as directed by Ausgrid's Engineering, to programmed replacement of equipment on a like for like basis. Its application to unscheduled or breakdown restoration works, and to other works, is by exception only and shall be as directed by Ausgrid's Engineering.

Requirements are included for environmental, civil, architectural, electrical primary, electrical secondary, control, protection, communications and SCADA aspects that shall be considered and included into the design and construction of Ausgrid's major substations.

This Network Standard:

- applies to sub-transmission substations (132kV/66kV/33kV, 132kV/66kV, 132kV/33kV) and typically these substations utilise transformers having nameplate ratings of 60MVA and 120MVA.
- applies to zone substations (132kV/11kV, 66kV/11kV, 33kV/11kV) and typically these substations utilise transformers having nameplate ratings of 19MVA, 33MVA, 37.5MVA and 50MVA.

3.0 REFERENCES

3.1 General

3.1.1 Standards

All plant and equipment supplied, and the design and construction work shall be carried out in accordance with ALL relevant Legislative, Regulatory and WorkCover New South Wales requirements and the relevant Ausgrid Network Standards (NS), Network Engineering Guidelines (NEG), Technical Specifications and Guides.

The relevant Australian Standards (AS) and the relevant IEC Standards, if an Australian Standard does not exist, should also be applied to the extent that is reasonable and appropriate. Any clarification in this regard should be sought from Ausgrid's Engineering.

3.1.2 Ausgrid technical specifications

All equipment shall comply with the requirements of the Ausgrid plant and equipment Technical Specifications contained in Ausgrid's "Balin" internal website under, Procurement and Contracts. Equipment not currently approved for use on the network can be submitted for consideration through the Network Standard NS181 Approval of Materials and Equipment and Network Standard Variation.

3.1.3 Industry codes and guidelines

Where no relevant Ausgrid, AS or IEC standard exists, the work shall comply with recognised standards of good electricity industry practice as adopted by the Australian Electricity Supply Industry. Where Ausgrid's requirements are in conflict with any Standard, direction shall be obtained from Ausgrid's Engineering.

Where the plant does not comply in some aspect with the requirements of this Network Standard, other Network Standards, Network Engineering Guidelines, Technical Specifications or Guides, the deviations shall be clearly stated in the design proposal.

ALL deviations from this Network Standard, other Network Standards, Network Engineering Guidelines or Technical Specifications SHALL be clearly stated and reported to the Ausgrid Representative. In the absence of other information it shall be assumed that the major substation complies with ALL of the requirements specified in this Network Standard, other Network Standards, Network Engineering Guidelines and Technical Specifications.

3.1.4 Climatic service conditions

The climatic conditions to which the plant, equipment and the major substation shall be exposed are detailed in:

- AS/NZS 1170 Structural design actions
- AS 2067 Substations and high voltage installations exceeding 1kV A.C.
- Bureau of Meteorology Climate maps for the “Annual Rainfall”, “Minimum Temperatures” and “Maximum Temperatures” in New South Wales
- Engineers Australia “Australian Rainfall and Runoff – A Guide to Flood Estimation”
- NS185 Major Substations Building Design Standard
- NS186 Major Substations Civil Works Design Standard

3.2 Ausgrid documents

The following list of documents is not exhaustive due to ongoing development and review of standards, guides and procedures and as such additional company documents or legislation may also be applicable.

- Bush Fire Risk Management Plan
- Be Safe Procedure 12 - Design
- Company Form (Governance) - Network Document Endorsement and Approval
- Company Procedure (Governance) - Network Technical Document Endorsement and Approval
- Company Procedure (Network) – Network Standards Compliance
- Company Procedure (Network) - Production / Review of Technical Documents within BMS
- Customer Installation Safety Plan
- DG 33 Distribution Guideline 33, Fire Bans
- DS 111 Design Standard 111, CAD Drawing Guidelines and Procedures
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- NEG-EP07 Network Access and Security – Locks and Keys
- NEG-EP09 Intruder Resistant Fences for Zone and Subtransmission Substations
- NEG-OH21 Vegetation Safety Clearances
- NEG-SE01 Power Frequency EMF – Prudent Avoidance
- NEG-SE 10 Traffic Management
- NEG-SM04 Specification for Design and Construction of Major Substations
 - NEG-SM04.1 Introduction and Reference Documents
 - NEG-SM04.5 Auxiliary Power Supplies and Switchgear
 - NEG-SM04.7 Selection of Substation Batteries
 - NEG-SM04.8 Earthing
 - NEG-SM04.11 Power Cables
 - NEG-SM04.14 Insulation Coordination
 - NEG-SM04.21 Light and Power
 - NEG-SM04.24.02 Testing and Commissioning of Building Services and Miscellaneous
 - NEG-SM04.24.03 Testing and Commissioning Instrumentation, Protection and Metering
 - NEG-SM04.24.04 Testing and Commissioning Primary and Secondary Plant
 - NEG-SM04.24.06 Inspection and Test Quality Procedure
 - NEG-SM04.25 Switchyard Steelwork
 - NEG-SM04.27 Power Cable Conduits
 - NEG-SM04.29 Specification for Design & Construction of Major Substations – Intertrip Batteries

- NEG-SM05 Site Assessment Process for Major Projects
- NEG-SM06 Reclosing Requirements for 11kV Vacuum Circuit Breakers at Zone Substations
- NEG-SM07 Active Fire Systems for Substations
- NEG-SM08 Noise Assessment
- NEG-SM09 Sulphur Hexafluoride (SF6)
- NEG-SM10 Spring Charging of Circuit Breakers
- NEG-SM12 Value Management, Buildability and Post Construction Evaluation
- NEG-SM14 Major Projects – Project and Equipment Design Reviews
- NEG-SM21 Design Requirements for AFLC Rooms Brownfield Locations
- NEG-SM22 Blasting Near Ausgrid Substations
- NEG-TC02 DNP3 over TCP/IP for Master Station to RTU Communications
- NEG-TC04 Bearer Availability Model
- NEG-TC06 Undergrounding Ausgrid PINC Optical Fibre Cables in Conjunction With Distribution Mains
- NEG-TC07 Requirements for testing and commissioning of Optical Fibre Communications Systems
- NEG-TC08.1.1 Telecommunications Dictionary
- NEG-TC08.1.2 Telecommunications Reference
- NEG-TC12 Telecommunications Site Codes
- NEG-TC15 Telecommunications Scheduled Outage Management of Optical Fibre
- NEG-TC17 Telecommunications Naming Conventions – Design Work Instruction
- NEG-TC19 Allocation of Optical Fibre Tubes Design Work Instruction
- NEG-TC28 Installation of Optical Fibre within Substations
- NS100 Field Recording of Network Assets
- NS104 Specification for Electrical Network Project Design Plans
- NS126 Construction of High Voltage Overhead Mains
- NS130 Specification for Laying of Underground Cables Up to and including 11kV
- NS135 Specification for the Construction of Overhead Sub-transmission Lines
- NS143 Easements, Leases and Rights of Way
- NS156 Working Near or Around Underground Cables
- NS158 Labelling of Mains and Apparatus
- NS161 Specification for Testing of Underground Cables
- NS162 Specification for the installation of Communication Cables in Ductlines and Substations
- NS165 Safety Requirements for Non-Electrical Work in and around Live Substations
- NS168 Specification for the Design and Construction of 33kV, 66kV and 132kV Underground Cables
- NS171 Fire Stopping in Substations
- NS172 Design Requirements for Cable Jointing Pits and Vaults
- NS174 Environmental Procedures
- NS177 11kV Joints (Including Transition Joints) & Terminations – Polymeric Insulated Cables
- NS178 Secondary System Requirements for Major Substations
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS185 Major Substations Building Design Standard
- NS186 Major Substations Civil Works Design Standard
- NS187 Passive Fire Mitigation Design of Substations
- NS188 Design for Substation Overpressure
- NS189 Oil Containment for Major Substations
- NS190 Oil Containment Operational Requirements for Major Substations
- NS191 Batteries and Battery Chargers in Major Substations
- NS200 Major Substations Ventilation Design Standard
- NS203 Telecommunications Network: Master Policy Document
- NS204 Communication Pits – Specifications and Installation Guidelines
- NS208.2.1 Telecommunications Communication Cabinet Architecture
- NS208.2.2 Telecommunications Substations Communication Cabinet Interconnectivity
- NS208.2.3 Telecommunications Substations Communication Cabinet Allocations
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS215 Telecommunications Allocation and Recording of Fibre Use Design Work Instruction

- NS220 Overhead Design Manual
- NS221 Telecommunications, Changes To In service Teleprotection Equipment Configuration Policy
- NS222 Major Substation Earthing Layout Design
- NS236 Installation of Electronic Perimeter Security at Major Substations
- Public Electrical Safety Awareness Plan
- Security Risk Policy
- SEC01 Protective Security Standard – Electronic Security Systems
- Stakeholders Relations Plan
- Tree Safety Management Plan

3.3 Other standards and documents

- AS 1055 - Acoustics (Series).
- AS 1100 - Technical drawing (Series).
- AS 1102 - Graphical symbols for electrotechnical documentation (Series).
- AS/NZS 1170 - Structural design actions (Series).
- AS 1243 - Voltage transformers for measurement and protection.
- AS 1307.2 - Surge arresters - Metal-oxide surge arresters without gaps for a.c. systems.
- AS/NZS 1429.1 - Electric cables - Polymeric insulated- For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV.
- AS/NZS 1429.2 - Electric cables - Polymeric insulated - For working voltages 19/33 (36) kV up to and including 87/150 (170) kV.
- AS 1767 - Insulating Liquids (Series).
- AS/NZS 1768 - Lightning protection.
- AS 1883 - Guide to maintenance and supervision of insulating oils in service.
- AS 1931.2 - High-voltage test techniques - Measuring systems.
- AS 2067 - Substations and high voltage installations exceeding 1 kV a.c.
- AS 2676 .1,.2 - Guide to the installation, testing and replacement of secondary batteries in buildings; Part 1 – Vented cells and Part 2 - Sealed cells.
- AS 2758.7 - Aggregates and rock for engineering purposes - Railway ballast.
- AS/NZS 3835.1,.2 - Earth Potential Rise - Protection of telecommunication network users, personnel and plant; Part 1 – Code of Practice and Part 2 – Application guide.
- AS/NZS 4029.2 - Stationary batteries – Lead acid – Valve regulated type.
- AS 4044 - Battery chargers for stationary batteries.
- AS/NZS 4853 - Electrical hazards on metallic pipelines.
- AS/NZS 7000 - Overhead line design – Detailed procedures.
- AS 60044.1- Instrument transformers - Current transformers (IEC 60044-1 Ed.1.2 (2003) MOD).
- AS 60044.2 - Instrument transformers - Inductive voltage transformers (IEC 60044-2:Ed.1.2 (2003) MOD).
- AS 60044.5 - Instrument transformers - Capacitor voltage transformers
- AS 60076 - Power transformers – including Parts
- AS/NZS 60265.1 - High-voltage switches - Switches for rated voltages above 1 kV and less than 52 kV
- AS 62271 - (12 parts: 100,200,300) High voltage switchgear and controlgear (Series) (including relevant IEC 62271, Ed. MODs).
- AS ISO 128 - Technical drawings - general principles of presentation (Series).
- D (b) 31 - Guide for the Maintenance of High Voltage Paper/Oil Insulated Cables and Accessories, Electricity Supply Association of Australia.
- ENA Doc 001 – 2008 National Electricity Network Safety Code
- ENA Doc 015 – National Guidelines for the Prevention of Unauthorised Access to Electrical Infrastructure
- ENA EG1-2006 Substation Earthing Guide.
- IEC 60141 - 1 Tests on Oil Filled and Gas-Pressure Cable and their Accessories- Part 1: Oil filled, paper or polypropylene paper laminate insulated, metal-sheathed and accessories for alternating voltages up to and including 500 kV.
- IEC60502 - 2 Power cables with extruded insulation and their accessories for rated voltages

from 1 kV up to 30 kV - Part 2: Cables for rated voltages from 6 kV up to 30 kV.

- IEC 60229 - Electric cables – Tests on extruded oversheaths with a special protective function.
- IEEE P400.2/D5 - Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF).
- ISSC3 Guideline for Managing Vegetation Near Power Lines
- Plus: current standards for insulating oil, HV bushings, HV cables and capacitors. etc.

3.4 Acts and regulations

- National Construction Code Series, Building Code of Australia (BCA)
- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014
- Industrial Noise Policy
- Protection of the Environment Operations Act (NSW)
- Work Health and Safety Act 2011 and Regulation 2011

4.0 DEFINITIONS

Accredited Service Provider (ASP)	An individual or entity accredited by the NSW Department of Industry, Division of Resources and Energy, in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).
Ausgrid Representative	For Service Provider delivered projects this will be the nominated Ausgrid Project Manager. For internally designed projects this will be the relevant Engineering or discipline Subject Matter Expert
Bay	Logical grouping of equipment associated with connection of an item of primary plant to a bus, or connection of two buses.
Business Management System (BMS)	An Ausgrid internal integrated policy and procedure framework that contains the approved version of documents.
Document control	Ausgrid employees who work with printed copies of document must check the BMS regularly to monitor version control. Documents are considered "UNCONTROLLED IF PRINTED", as indicated in the footer.
Major substation	Zone and Sub-transmission substations with a primary voltage of 132, 66, or 33 kV.
Network Standard	A document, including Network Planning Standards, that describes the Company's minimum requirements for planning, design, construction, maintenance, technical specification, environmental, property and metering activities on the distribution and transmission network. These documents are stored in the Network Category of the BMS repository.
Review date	The review date displayed in the header of the document is the future date for review of a document. The default period is three years from the date of approval. However a review may be mandated at any time where a need is identified due to changes in legislation, organisational changes, restructures, occurrence of an incident or changes in technology or work practice.
Substation	Refer definition for Major substation.

5.0 WORK HEALTH AND SAFETY ACT (NSW)

The Work Health and Safety Act 2011 (NSW), Part 2 Division 3 provides that a person (the **designer**) who conducts a business or undertaking that designs a plant, substance or structure, has duties under Section 22 of the WHS Act.

Under the Act the designer must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed to be without risks to the health and safety of persons who use, handle, store, construct or carry out other reasonably foreseeable activity in relation to the plant, substance or structure.

This duty includes inspection, operation, cleaning, maintenance or repair, decommissioning, dismantling and disposal and applies to persons who are exposed to the plant, substance or structure at or in the vicinity of the workplace.

A Designer Safety Report shall be prepared at the completion of the design development process and the format of the project WHS Risk Register will be subject to Ausgrid approval.

6.0 PROJECT OVERVIEW

6.1 General

This document outlines the technical criteria that shall be considered in the design of Ausgrid zone and sub-transmission substations. It specifies the environmental, civil, architectural, electrical primary, electrical secondary, control, protection, communications and SCADA work to be completed in the substation and line or cable works to be completed external to the substation.

The substation may be developed in stages to accommodate the ultimate layout as outlined in the Ausgrid Development Brief and the associated engineering documents, single line diagram, control schedules and protection schedules. Ausgrid shall advise in writing of any required departures or variations from Ausgrid's Network Standards.

To establish or develop the major substation, complete in every way, the project scope shall include:

- the design, engineering, administration, project management, supply, construction, installation, related decommissioning, testing and commissioning of the major substation;
- the supply of the plant, equipment and materials, other than those to be free issued by Ausgrid, necessary to commission the major substation into service in a manner that meets Ausgrid's requirements; and
- the co-ordination of all work required for the development of the site.

The characteristics of Ausgrid's electrical network shall be detailed in the Ausgrid Development Brief and the associated plant data sheet, single line diagram, control schedules and protection schedules for each major substation.

All design work drawings, calculations and manufacturer's information shall be co-ordinated, carried out and reviewed by a Professional Engineer unless otherwise authorised in writing by Ausgrid. All persons shall be qualified and experienced in the design of major substations. All design work shall clearly identify the name and authority of the design engineer, the reviewing engineer and the approving engineer.

6.2 Augmentation and replacement works

6.2.1 General

Design related decisions increasing project costs, associated with incorporating additional requirements to mitigate risks or achieve ALARP over the level existing at the site immediately prior

to the intended works shall be individually detailed for Ausgrid Engineering review. Significant costs arising from current design principles that would be avoided if existing site designs were employed shall also be detailed.

This Network Standard can be applied to significant augmentation works at existing substations, and to programmed replacement of equipment on a like for like basis. These will all be scheduled major works and a number of scenarios are possible, as outlined below.

6.2.2 Augmentation works - new bays

Where substations are to be augmented by erection of new bays where no specific civil or equipment construction existed previously, then all new construction within the bay confines shall be designed in accordance with current relevant Network Standards.

6.2.3 Augmentation works - existing bays

Where substations are to be augmented by commissioning of existing out of service (WDNO – Warning Do Not Operate) bays the design works shall consider bringing the bay up to the current relevant Network Standard requirements where no significant additional costs and or re-work arise. Otherwise, the requirements of the existing design and the standards that were applicable at the original time of construction shall be maintained.

6.2.4 Replacement works – existing bays

Where substations are to undergo scheduled replacement works the design works shall extend to the nominated equipment item(s) and associated interfaces only. The replacement is to be undertaken on a like for like basis to the pre-existing installed design.

However, where no significant additional costs and/or re-work arise, the current relevant Network Standard requirements can be adopted. Otherwise, the requirements of the existing design and the standards that were applicable at the original time of installation shall be maintained.

6.3 Consultation and approvals

Community consultation issues shall be dealt with by Ausgrid in accordance with the Ausgrid's Stakeholders Relations Plan and the environmental aspects for the related works shall be covered in Ausgrid's Environmental Impact Assessment. Both documents shall be produced by Ausgrid for all projects.

The project scope may include selected community consultation activities under the direction of Ausgrid as well as requirements for obtaining the necessary planning permits, building permits and approvals from Statutory Authorities for the development of the site.

6.4 Alternative plant and equipment

Plant or equipment failures and any outages necessary to carry out maintenance can have a major impact on Ausgrid's performance. If plant or equipment other than that available on Ausgrid contracts is proposed for use, supporting data shall be supplied on the historical performance of the plant and equipment to confirm that the plant and equipment being offered is reliable, easily maintained and repaired, with appropriately available spare parts. Any special tools or parts that are required shall be itemised and costed as part of the design proposal.

All proposals requiring the use of alternative plant and equipment shall be subject to the written approval of Ausgrid.

6.5 Project execution plan

A detailed Project Execution Plan, covering all aspects of the project work, shall be prepared. This is to be approved by Ausgrid and updated as required by, or with the agreement of, Ausgrid. Project management meetings shall be scheduled and convened on a regular basis to manage the completion of the major substation in accordance with this Plan. The milestones in this Plan shall be used to generate the Key Performance Indicators that shall be used to monitor progress.

Work shall not commence until the Project Execution Plan has been reviewed and accepted by Ausgrid.

The Project Execution Plan shall make provision for the project and equipment design reviews required by Ausgrid. This shall include but not be limited to the following:

- Site Assessment
- Project Delivery Risk Review
- Value Management and Buildability Assessment
- Equipment WH&S Review
- Equipping, Operability, Maintainability and End of Life Replacement Assessment
- Construction Hazard Assessment Implication Review (CHAIR)
- Environmental Assessment Review
- Designer Safety Reports
- Post Civil Construction Evaluation
- Post Commissioning Review

The project and equipment design reviews shall commence at the completion of the high level concept design for the major substation. The high level concept design shall include the initial civil plans and sections, primary general arrangement and sections, building layout, indoor switchgear arrangement and cubicle layout.

The project and equipment design reviews shall involve Ausgrid personnel from the field, operations, engineering, project management and asset investment as appropriate.

The Project Execution Plan shall also include Inspection and Test Plans for each item of plant and equipment as well as programs for the delivery of documentation, drawings and training for the project.

Commissioning shall be undertaken by Ausgrid in accordance with the Commissioning Plan included in the Project Execution Plan. At least eight weeks notice of the proposed commissioning program shall be provided to the Ausgrid Representative to ensure that it can be integrated into the overall network works program.

6.6 Strategic spares

Ausgrid has an established strategic spares policy for major substations that defines the technical, purchasing and inventory requirements for strategic spares. Ausgrid shall advise in writing of any specific requirements for strategic spares associated with the project work.

7.0 QUALITY ASSURANCE

7.1 General

The standard of major substation design shall be controlled by the effective implementation and administration of a quality system that meets Ausgrid's requirements. The quality system elements shall be in accordance with ISO 9001 and Ausgrid may conduct reviews to ensure that these standards are being maintained.

7.2 Quality of materials, equipment and workmanship

Except as where specifically approved in writing by Ausgrid, materials and equipment shall be new and of a quality at least equal to that stated in this Network Standard, other Network Standards, Guidelines or Technical Specifications.

All work shall be carried out by suitably qualified persons having experience in the particular types of work to be executed.

7.3 Quality in the absence of detailed specification

Where no detailed specifications have been provided for the supply of materials or manufactured articles, the materials and manufactured articles shall be of the most suitable grade in quality and workmanship obtainable in the market from firms of established good reputation or, if not ordinarily carried in stock, shall conform to the best accepted standard of the relevant trade for articles of the kind required with due consideration of the use to which these are to be put, and the specified design life. An approval process shall be put in place by Ausgrid for these materials or manufactured articles.

8.0 ENVIRONMENT AND SAFETY

8.1 Environmental Code of Conduct

Ausgrid has established an environmental code of conduct, which explains Ausgrid requirements and the need for all employees and contractors to act in relation to environmental laws. Refer to NS174 and Ausgrid Website at www.ausgrid.com.au.

8.2 Environmental Impact Assessment (EIA)

Environmental Impact Assessments (EIA) must be prepared and submitted with the concept design documents for all Ausgrid projects in accordance with NS174 and related documents.

The design of the substation and the environmental impact assessment are integral processes. Early interaction is required to ensure effective co-ordination between the design and the environmental impact assessment. This is to ensure environmental controls are incorporated into the substation design for greater effect and cost efficiency.

8.3 Electrical safety

All work involving access to Ausgrid's network must be carried out in accordance with the Electrical Safety Rules, particularly in relation to access permits, system alterations and equipping permits.

8.4 Site contamination

Site investigations shall be carried out to confirm there are no significant site contamination issues and that the proposed site is suitable for the location of a major substation. All work shall be carried out in accordance with the NS174 Environmental Procedures, Environmental Handbook, EIA Guidelines, EIA Worksheet, and NEG-SM05 Site Assessment Process for Major Projects.

8.5 Material safety aspects

Full details shall be provided, including composition and toxicological information, regarding the health and safety aspects of any materials that are to be used in the substation and that are known to have a risk to health or the environment.

Material Safety Data Sheets shall be provided together with the recommended procedures for the safe handling, operation, maintenance and disposal of the products employed.

8.6 EMF study

The electromagnetic field levels shall be considered during the design phase, and shall be measured and recorded across the substation site before any construction work commences and following the completion of the construction work. Attention is drawn to NEG-SE01 Power Frequency EMF–Prudent Avoidance and The Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields (1Hz – 100kHz).

8.7 Electro-magnetic Fields (EMF)

Adequate clearances may be a suitable control measure, when required, for electro-magnetic fields generated by the electrical equipment and cables. Appropriate boundary clearances are required to ensure minimum section safety clearances are maintained to the electrical equipment. Refer to NEG-SE01 Power Frequency EMF – Prudent Avoidance.

8.8 Sound levels

The major substation shall comply with the sound level requirements of the New South Wales Protection of the Environment Operations Act, the NSW Industrial Noise Policy and any Development Consent Conditions for the development.

The background sound levels shall be considered during the design phase, and shall be measured and recorded across the substation site before any construction work commences.

Noise assessment for the substation shall be undertaken in accordance with the requirements of NEG-SM08 Noise Assessment.

The maximum permissible sound level for each major plant item is specified in the Ausgrid Technical Specification for the particular item of plant.

8.9 Sustainable development

The design of substations must take into account issues associated with sustainable development. The main issues to consider are:

- Material usage in relation to thermal efficiency, embodied energy and greenhouse gas emission abatement
- Reduced natural resource consumption
- Waste avoidance, reuse and recycling
- Plant efficiency
- Design Life and Durability
- Stormwater control
- Pollution prevention – noise, water, soil and light
- Compatibility and sensitivity with the local built environment.

These issues must be addressed and resolved during the feasibility and concept design stages.

9.0 CIVIL AND BUILDING WORKS

9.1 Site investigations

Refer to NS186 Major Substations Civil Works Design Standard and NEG-SM05 Site Assessment Process for Major Substations for requirements regarding site investigations.

9.2 Boundary clearances

The boundary clearance is influenced by requirements of the following:

- Local Authority,
- BCA radiant heat limits,
- Ausgrid radiant heat limits,
- EMF,
- electrical clearances,
- access,
- security,
- maintenance, and
- noise constraints/emissions.

Refer also to, and comply with, NEG-EP09 Intruder Resistant Fences for Zone and Sub-transmission Substations.

Boundary and other clearances are also required to facilitate the installation of the earthing ring. The Block Plan and Layout Plan shall provide clearances for use in design.

9.3 BCA compliance

Major substations are currently considered to be Class 8 buildings under the Building Code of Australia (BCA). All substations shall comply with the relevant provisions of the BCA as required by NS185 Major Substations Building Design Standard.

9.4 Transformer foundations, bunding and enclosures

Transformer installations shall meet the requirements of NS189 Oil Containment for Major Substations.

The transformer foundations and oil bunds shall be installed in a manner that caters for the ultimate transformation capacity of the station. Suitable foundation provisions shall be made to facilitate the installation of sound walls or thermal barriers, as required.

The oil separator shall be an Ovivo EnviroSEP type OS 7500 or approved equivalent and shall be installed in accordance with the manufacturer's recommendations.

9.5 Radiant heat

The requirements of NS187 Passive Fire Mitigation Design of Substations must be met in relation to radiant heat flux levels from substation elements such as transformers which can burn. These heat flux levels may dictate separation distances to neighbouring properties.

9.6 Segregation

Adequate separation distances shall be provided between the edge of a transformer bund and;

- other transformers
- the substation building(s).

Where transformer bunds are common or the necessary separation distances cannot be satisfied, a fire separation wall shall be installed between the transformers and/or building(s) in accordance with NS187 Passive Fire Mitigation Design of Substations.

9.7 Fire services

Fire services shall be installed and commissioned in accordance with the requirements of Local Authorities and NS185 Major Substations Building Design Standard, NS186 Major Substations Civil Works Design Standard, NS187 Passive Fire Mitigation Design of Substations and NEG-SM07 Active Fire Systems for Substations.

9.8 Overpressure

The design of the substation building shall consider the impact of overpressures and, where appropriate, shall comply with the overpressure requirements of NS185 Major Substations Building Design Standard and NS188 Design for Substation Overpressure.

9.9 Mine subsidence

At site locations within or near a mine subsidence area the design of the substation building shall comply with the mine subsidence provisions of NS185 Major Substations Building Design Standard.

9.10 Mine vibration

Where proposed substations sites are likely to be subject to vibration from mine blasting activities then early reference should be made to Ausgrid's Engineering department for direction. Further details on requirements are available in Network Engineering Guideline NEG SM22 Blasting Near Ausgrid Substations.

9.11 Security

Design and commissioning of intruder detection systems/services shall comply with Ausgrid's Security Risk Policy, NS 236 Installation of Electronic Perimeter Security at Major Substations, SEC01 Protective Security Standard – Electronic Security Systems, EP07 Network Access and Security – Locks and Keys, EP09 Intruder Resistant Fences in addition to the ENA Doc 015 – National Guidelines for the Prevention of Unauthorised Access to Electrical Infrastructure, electricity industry security standards and State/Federal Government Critical Infrastructure Protection Frameworks.

9.12 Substation building design

The design of the substation building shall comply with NS185 Major Substations Building Design Standard.

9.13 Site and civil works

The design of the substation site and civil works shall comply with NS186 Major Substations Civil Works Design Standard.

10.0 PRIMARY ELECTRICAL WORKS

10.1 Substation layout

The substation shall be designed to accommodate the ultimate arrangement as shown in separate Ausgrid documents for each substation and the associated engineering documents, single line diagram, control schedules and protection schedules.

Consideration shall be given to safe work at heights. Adequate space shall be provided around equipment to ensure that ladders, scaffolding and elevated work platforms can be utilised safely as required. Consideration shall be given to the provision of permanent work platforms where appropriate in areas where work will be carried out frequently.

Where specified, the substation shall be designed to facilitate the installation of Ausgrid's mobile switchroom and/or mobile substation in the event of an emergency. Refer to the relevant deployment plans available in Ausgrid's "Balin" internal website under "Manufacturer's Equipment Manuals - Substations".

10.2 Plant and equipment

Plant and equipment shall be designed to be supplied and installed in stages, to accommodate the ultimate arrangement, as outlined in Ausgrid Development Brief for the particular substation and the associated plant data sheet, single line diagram, control schedules and protection schedules.

The plant and equipment supplied shall meet the requirements of Ausgrid's Technical Specifications. Where no Ausgrid Technical Specification exists, the technical details of the proposed plant and equipment shall be submitted to Ausgrid Representative for approval.

Technical Specifications shall be supplied by Ausgrid on request. The current plant and equipment Technical Specifications are provided in Ausgrid's "Balin" internal website under Procurement and Contracts.

10.3 Electrical clearances

Appropriate safety and working clearances shall be maintained in the design of equipment and structures. Clearances in air and safety clearances shall comply with the requirements of Ausgrid's Electrical Safety Rules and associated documents.

All designs are to ensure appropriate safety and working clearances are maintained in the design of equipment and structures.

Safe approach distances shall comply with the requirements of the Electrical Safety Rules.

Section safety clearances must comply with the following Ausgrid engineering drawings:

- 221830 – Outdoor Substations Diagrammatic Layout of Equipment Safety Clearances for Substation Design.
- 221831 – Outdoor Switchyards Comparison of High Voltage Clearances.
- AS2067 – High Voltage Installations exceeding 1kV a.c.

10.4 Earthing and lightning protection

The earthing system shall be designed so that it manages the transfer of fault energy in such a manner as to limit the risk to people (both Ausgrid staff and the general public), equipment and system operation to acceptable levels. Refer to NEG-SM04.8 - Earthing for details.

Insulation co-ordination issues need to ensure that incoming lines and substation equipment BIL/lightning impulse levels are not exceeded as a result of lightning activity. Designs are to be in accordance with AS 1786 to ensure adequate lightning protection for personnel within the substation site. Refer to NEG-SM04.14 – Insulation Coordination for details.

10.5 Auxiliary power supplies

The auxiliary power supplies shall be designed and installed in accordance with NEG-SM 04.5 Specification for Design and Construction of Major Substations, Auxiliary power Supplies and switchgear.

The substation light and power system shall be designed and installed in accordance with NEG-SM 04.21 Specification for Design and Construction of Major Substations, Light and Power.

10.6 Nameplates and labelling

All nameplates shall be supplied and fitted in accordance with the requirements of NS158 Labelling of Mains and Apparatus.

For indoor fixed pattern type switchboards a mimic diagram shall be applied to the front cover of all high voltage cubicles indicating the high voltage equipment that is installed in the compartment and the direction of busbar conductors. The graphical symbols shall be in accordance with IEC Publication 417.

All internal panel secondary circuit panel wiring shall include individual wire labelling at each termination in accordance with Control & Protection drawings or, for equipment, as per the equipment specification.

Multicore control and protection cabling shall be labelled at each end with the relevant design drawings cable coding.

All fibre optic cables shall be labelled at each end as per the relevant Network Standard.

10.7 Power cable works

All underground power cables shall be supplied and installed in stages to accommodate the ultimate layout, as outlined in Ausgrid's Development Brief for the major substation and as required by:

- NS130 Specification for Laying of Underground Cables Up to and including 11kV
- NS161 Specification for Testing of Cables after Installation
- NS172 Design Requirements for Cable Jointing Pits and Vaults
- NS177 11kV Joints (including Transition Joints) and Terminations - Polymeric Insulated Cables
- NEG-SM 04.11 Power Cables
- NEG-SM 04.27 Power Cable Conduits

10.8 Provision for emergency mobile substations and switchrooms

The details of the required provisions to be made for accommodation and connection of emergency mobile substations and switchrooms shall be specified by Ausgrid.

10.9 11kV Works

10.9.1 11kV overhead line works

The details of the required 11kV overhead line works for major substations shall be specified by Ausgrid and shall be in accordance with NS126 Construction of High Voltage Overhead Mains.

10.9.2 11kV underground cable works

The details of the required 11kV underground cable works external to the substation shall be specified by Ausgrid and shall be in accordance with NS130 Specification for Laying of Underground Cables Up to and including 11kV.

10.10 33kV-132kV works

10.10.1 33kV-132kV overhead line works

The details of the required 33kV-132kV overhead line works for major substations shall be specified by Ausgrid and shall be in accordance with NS135 Specification for the Design & Construction of Overhead Sub-transmission Lines.

10.10.2 33kV-132kV underground cable works

The details of the required 33kV-132kV underground cable works external to the substation shall be specified by Ausgrid and shall be in accordance with NS168 Specification for the Design and Construction of 33kV, 66kV and 132kV Underground Cables.

10.11 Other electrical works

The details of any other electrical works required for the substation shall be specified by Ausgrid.

11.0 SECONDARY SYSTEMS WORKS

11.1 Existing control & protection schemes and panels

Where serviceable, and where not specifically identified for replacement, the existing control and protection relays, panels and circuitry shall be retained unless approved otherwise by Ausgrid prior to the commencement of detailed design.

11.2 Control, protection, SCADA and metering

Control, Protection, SCADA and Metering schemes shall be designed to meet the requirements of the Ausgrid Development Brief and NS178 Secondary System Requirements for Major Substations.

Changes to the control, protection, SCADA and metering schemes at more than one major substation site may be required. These requirements shall be specified by Ausgrid.

11.3 Communications

Communications schemes shall be designed to meet the requirements of Ausgrid Development Brief and:

- NS162 Specification for the installation of Communication Cables in Ductlines and Substations
- NS169 Telecommunications Installations on Ausgrid HV Transmission Towers
- NS 203 Telecommunications Network: Master Policy Document
- NS204.2.1 Communication Pits – Specifications and Installation Guidelines
- NS208.2.1 Telecommunications Communication Cabinet Architecture
- NS208.2.2 Telecommunications Substations Communication Cabinet Interconnectivity
- NS208.2.3 Telecommunications Substations Communication Cabinet Allocations
- NEG-TC02 DNP3 over TCP/IP for Master Station to RTU Communications
- NEG-TC05 DC Power Connection to PINC Communication Racks

Changes to the communications schemes at more than one major substation site may be required. These requirements shall be specified by Ausgrid.

11.4 DC supplies batteries and battery chargers

Substation batteries shall be designed and installed in accordance with the following:

- NS191 Batteries and Battery Chargers in Major Substations

- NEG-SM 04.7 Specification for Design and Construction of Major Substations, Batteries and Battery Chargers.

12.0 INSPECTION AND TESTING

12.1 General

In the absence of other agreed or contracted requirements, the following inspection and testing requirements shall apply.

Inspection and Test Plans covering all aspects of the type, routine, factory acceptance, erection, functional and post-commissioning testing proposed for each item of plant and equipment. The testing shall be carried out in accordance with the Ausgrid Technical Specifications for each item of plant and equipment and, NEG-SM 04.24 series Specification for Design and Construction of Major Substations, Testing and Commissioning.

Test requirements that are subject to agreement by Ausgrid shall be submitted for review and approval.

12.2 Test procedures

All test procedures shall be documented and submitted to the Ausgrid Representative for approval at least eight weeks prior to the commencement of the testing. A complete, certified test report shall be produced in hard copy and electronic form, in English, for each test carried out. Each test report shall reference the test procedures that were followed in completing the tests and the certification / quality assurance of the test laboratory.

An "original" of all test records, reports, and certificates, including a comparison between expected and actual test results, shall be submitted in hard copy and electronic form to the Ausgrid Representative for approval within 2 weeks of the completion of the testing. Approval, or otherwise, together with any comments on the test records and reports, shall be provided by the Ausgrid Representative in writing within 3 weeks of the date of receipt of the report by the Ausgrid Representative.

Note: The Ausgrid Representative shall be informed, without delay, of any failure or abnormality in the test results and a written report shall be submitted within two weeks giving an explanation for the abnormality and recommended remedial action.

12.3 Tests and Certificate of Rating

Complete, certified type test reports shall be supplied for each type test that is completed on each item of plant and equipment.

Where type tests have been performed previously the complete test results, certified by a recognised independent NATA or equivalent certified Testing Authority, shall be submitted to the Ausgrid Representative for consideration.

Complete, certified routine test reports shall be supplied for all electrical, mechanical and functional tests completed on the plant and equipment installed to confirm that it is functioning correctly in accordance with the design, the manufacturer's specifications and Ausgrid's requirements.

12.4 Witnessing tests and Ausgrid testing

Ausgrid reserves the right to witness any type test OR routine test OR carry out any additional testing on the plant supplied to prove compliance with any Ausgrid requirement.

13.0 COMMISSIONING

A Commissioning Plan covering all aspects of commissioning the substation into service shall be provided. Commissioning shall be carried out in accordance with NEG-SM 04.24 series Specification for Design and Construction of Major Substations, Testing and Commissioning.

Note: The energisation of all plant and equipment during commissioning shall be performed by Ausgrid operations staff.

Once plant and equipment has been commissioned into service and its control has been transferred to Ausgrid, only authorised persons shall be permitted on site and all access shall be under the terms of the appropriate Access Authority issued.

14.0 DOCUMENTATION AND DRAWINGS

14.1 General

The delivery program for all documentation and drawings shall be detailed in the Project Execution Plan.

The required documentation shall be delivered, complete with document transmittal form, as:

- one complete hard copy;
- one electronic copy of all documents in Adobe pdf format and one AutoCAD 2013 version of all drawings; and
- one electronic copy of all documents and drawings in pdf format.

All documents and drawings shall be in English and the hard copies mounted in substantial bindings with an index to enable specific items to be quickly and accurately located. All dimensions and measurements shall be in metric units.

14.2 Project documentation

- Documentation to be supplied as part of the project will be dependent on the project complexity, for a new substation project documentation shall include, but is not limited to, the following: Risk analysis workshop records
- Value Management Report and Buildability Assessment
- Site Assessment Report in accordance with NEG-SM05
- Details of any variations to accepted Network Standards, Network Engineering Guidelines or Specifications that are included in the design.
- Noise impact assessment report
- Schematic Design Stage Details
- Feasibility Stage Details
- DA Drawings
- Fire Report as required by NS187
- Designer Safety Reports
- Commissioning plans
- "As Built" drawings
- OEM Manuals for all Equipment
- OEM software versions applicable at time of commissioning
- Substation Operating Manual
- Maintenance Procedures and Operation Manuals for building and civil works (Refer: NS185 and NS186)
- All test procedures, records, reports and certificates
- All site commissioning records
- Construction Certificate
- Completion/Occupation Certificate
- Updated GIS information (particularly for all feeder works)

- Updated SAP information for all substation equipment
- Integrated support requirements in accordance with NS212
- Protection settings documentation in accordance with sections 14.2.1 and 14.2.2

14.2.1 Protection settings

Protection calculations shall be completed to determine all of the protection settings that are required to achieve the required protection reach, stability under through faults (out of zone faults for unit protection schemes), time coordination and load carrying capability.

These calculations shall demonstrate that the protection settings are fit for purpose prior to the commencement of commissioning works and they shall be documented in a complete protection study report for the substation.

Protection settings shall not restrict plant and equipment utilisation. Where protection settings may restrict plant and equipment utilisation, the restriction shall be documented and presented to the Ausgrid Representative for approval prior to ordering any equipment or commencing any site works.

14.2.2 Recording of protection settings

“Setting sheets” shall be created and entered into a Computer Automated Protection Design System. All relevant information shall be attached to the setting sheets for the respective schemes and shall include:

- Summary documentation describing the relay settings in both primary and secondary values;
- Distance protection polar plots demonstrating protection coverage for line faults including arc resistance and coverage through transformers for remote backup conditions;
- Protection time vs current characteristics demonstrating protection coordination;
- Electronic setpoint files created with the native relay interfacing software for application into the relay;
- Relay setpoint inspection files (ASCII dump of all relay setpoints, .txt or .pdf files) to allow relay setting without the means of the relay interface software;
- Maximum Safe Load (MSL) charts, plotting operate and non operate regions of the protection relays for the applicable voltage levels. The charts shall be configured with the X Axis representing MW and the Y Axis representing MVAR with a series of curves for applicable bus voltages plotted.

14.3 Civil & building maintenance and operation manual

A maintenance and operation manual shall be provided, detailing the philosophy, configuration, materials, finishes and maintenance requirements adopted in the design of the substation. The manual shall detail the operation and maintenance philosophy to be employed to achieve the specified standard of performance and service life of the civil and building assets.

Subject to Ausgrid’s requirements based on the complexity of the project, and to enable progressive and timely development and checking of the manual, the following documentation may be required at various stages throughout the project. These stages include Design Review, Construction, Practical Completion, Commissioning and Handover.

- OEM Operational & Maintenance Manuals
- Certifications
- Inspection and Test Plans
- Sub-consultant As-Built & Shop Drawings
- Product Data Sheets
- Warranties

- Schedule of Sub-Contractor & Supplier Details
- Finishes Register
- Security systems, including fencing and gates
- Mobile Crane access plan
- Oil containment/ separation details
- Residual Risk Register
- Emergency Information Plan
- Emergency Drainage Plans

14.4 Equipment manuals

Manuals shall be provided in accordance with NS212 Integrated Support Requirements for Ausgrid Network Assets.

14.5 Drawing standards

All drawings shall comply with the requirements detailed in the Design Standard 111 CAD Drawing Guidelines and Procedures.

Drawings shall be produced on templates supplied by Ausgrid and shall be prepared in accordance with AS ISO 128 Technical drawings, general principles of presentation, AS 1100 Technical drawing, AS 1102 Graphical symbols for electrotechnical documentation and NS158 Labelling of Mains and Apparatus. The templates shall include the Ausgrid border, title block and format. All drawings shall be consistent with the format of the Ausgrid “Major Substation Sample Drawings”.

Electronic files shall be appropriately structured for quick and accurate location in accordance with Ausgrid written instructions. PDF copies of drawings and specifications are to be provided as well as editable AutoCAD and word documents.

Drawing revisions shall be clearly marked with the details of the respective revisions recorded in designated ‘revision blocks’.

As Installed drawings, stencilled “As Installed Drawing”, shall be provided that contain a complete record of the work as at Practical Completion.

14.6 Ausgrid’s engineering drawings

Ausgrid has an electronic data base – Technical Documentation Management System (TDMS) for the management, storage and retrieval of engineering drawings. The TDMS also provides version control of Ausgrid’s drawing files.

15.0 TRAINING

Where installed equipment will differ from that already utilised within Ausgrid, specific training may be required on the operations and maintenance aspects of the equipment as used in the substation.

Training is a specific deliverable and shall be included as part of the Project Execution Plan. A training program in accordance with the requirements of NS212 Integrated Support Requirements for Ausgrid Network Assets shall be submitted to the Ausgrid Representative for approval. Training shall be provided in accordance with the approved training program as part of the project works.

16.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Table 1 – Recordkeeping

Type of Record	Storage Location	Retention Period*
Approved copy of the network standard	BMS Network sub process Standard – Company	Unlimited
Draft Copies of the network standard during amendment/creation	HPRM Work Folder for Network Standards (HPRM ref. 2014/21250/157)	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	HPRM Work Folder for Network Standards (HPRM ref. 2014/21250/157)	Unlimited

* The following retention periods are subject to change eg if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

17.0 AUTHORITIES AND RESPONSIBILITIES

For this network standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this network standard can be obtained from the Company Procedure (Network) – Production/Review of Network Standards. The responsibilities of persons for the design or construction work detailed in this network standard are identified throughout this standard in the context of the requirements to which they apply.

18.0 DOCUMENT CONTROL

Content Coordinator : Manager Transmission and Distribution Substations Engineering
Distribution Coordinator : Engineering Information and Services Manager

Annexure A –Sample Compliance Checklist



Network Standard Checklist Form

NS210 Documentation and reference design guide for major substations

Project Identification:	
Prepared by: <Name & Position Title>	Date:

This checklist is for internal Ausgrid use only and does not apply to ASPs or contractors who have specific compliance requirements in relation to Contestable project works. The checklist is unique for each network standard and is available within BALIN and the BMS as a separate form that can be amended as required, completed and saved in TRIM with the other project documentation.

This section is used to identify compliance checks that when applied to the work associated with this Network Standard will satisfy an audit process to establish that the requirements of the standard have been followed. It is expected that applicable items would normally be checked as Comply (Yes) as non-compliance is generally not tolerated.

Where non-compliance is the result of specific site conditions or design decisions this needs to be identified in the notes section of the form for each non-compliance and approval sought from an appropriately authorised Ausgrid manager responsible for design approval per NS261 Compliance Framework for Network Standards.

Should additional information be available to document non-compliance decisions, these can be attached to the checklist form. The checklist and any attached explanatory notes should be saved in the project document repository.

Item	Description	Refer Clause	Completed/ Actioned
	Scope		
	This Network Standard: <ul style="list-style-type: none"> applies to sub-transmission substations (132kV/66kV/33kV, 132kV/66kV, 132kV/33kV) and typically these substations utilise transformers having nameplate ratings of 60MVA and 120MVA. applies to zone substations (132kV/11kV, 66kV/11kV, 33kV/11kV) and typically these substations utilise transformers having nameplate ratings of 19MVA, 33MVA, 37.5MVA and 50MVA. 	2.0	N/A
	Project Overview, Quality and Environment		
1	Development brief and the associated plant data sheet, single line diagram, control schedules and protection schedules are prepared.	1.0, 6.1	Yes/No/NA
2	Designer Safety Report prepared and received.	5.0	Yes/No/NA
3	Significant costs that may be avoided if changes made have been advised.	6.2.1	Yes/No/NA
4	All new works comply with current design principles and network standards.	6.2.2	Yes/No/NA
5	All existing assets requiring re-work done to current standards where costs are not an impact otherwise assets used in accordance with standards applying at the time of construction.	6.2.3, 6.2.4	Yes/No/NA

Item	Description	Refer Clause	Completed/ Actioned
6	Stakeholders Relations Plan and Environmental Impact Assessment Reports prepared if required.	6.3	Yes/No/NA
7	Alternative equipment or plant has been proposed and assessed by Ausgrid.	6.4	Yes/No/NA
8	Project execution plan prepared as required.	6.5	Yes/No/NA
9	Strategic spares have been identified and advised.	6.6	Yes/No/NA
10	Designs in accordance with ISO 9001.	7.1	Yes/No/NA
11	Except as approved all materials used are new and comply with Ausgrid network standards and specifications.	7.2	Yes/No/NA
12	All works and activities comply with Ausgrid's Environmental Code of Conduct.	8.1	Yes/No/NA
13	Environmental Impact Assessment prepared and submitted with concept design documents.	8.2	Yes/No/NA
14	All works undertaken in accordance with the Electrical Safety Rules.	8.3	Yes/No/NA
15	Site investigations performed to determine if any significant site contaminations.	8.4	Yes/No/NA
16	Materials used in the design that are known to be a risk to health and safety have been identified and required data provided.	8.5	Yes/No/NA
17	EMF levels measured and recorded as required.	8.6	Yes/No/NA
18	Appropriate EMF control measures have been applied.	8.7	Yes/No/NA
19	Sound levels comply with NSW legislative requirements.	8.8	Yes/No/NA
20	Design takes into account issues associated with sustainable development.	8.9	
	Civil, Primary and Secondary Electrical Works		
21	Appropriate site investigations have been undertaken.	9.1	Yes/No/NA
22	Appropriate boundary clearances have been maintained.	9.2	Yes/No/NA
23	Building Codes of Australia compliance for Class 8 buildings has been achieved.	9.3	Yes/No/NA
24	Transformer foundation, bunding and enclosure requirements have been met.	9.4	Yes/No/NA
25	Requirements of NS187 Passive fire Mitigation Design of Substations have been met.	9.5	Yes/No/NA
26	Fire services installed and commissioned in accordance with local authorities and Ausgrid standards.	9.7	Yes/No/NA
27	Overpressure requirements of NS185 and NS188 have been met.	9.8	Yes/No/NA
28	Site locations within or near mine subsidence areas, comply with mine subsidence provisions of NS185.	9.9	Yes/No/NA
29	Site locations likely to be subject to vibration from mine blasting activities have been referred for Ausgrid engineering review.	9.10	Yes/No/NA
30	Security requirements have been met.	9.11	Yes/No/NA
31	Substation building requirements as required by NS185 Substation Building Design Standard have been met.	9.12	Yes/No/NA
32	Site and civil works comply with NS186 Major Substations Civil Works Design Standard.	9.13	Yes/No/NA
33	Substation design is in accordance with Ausgrid development brief and has accounted for general operational considerations for safe working.	10.1	Yes/No/NA
34	Provision has been made to facilitate installation of mobile switchroom and/or mobile substation where specified as a requirement.	10.1, 10.8	Yes/No/NA
35	Plant and equipment supplied complies with Ausgrid specifications and requirements.	10.2	Yes/No/NA
36	Appropriate safety and working clearances have been maintained in the design of equipment and structures.	10.3	Yes/No/NA
37	Earthing system design in accordance with Ausgrid requirements.	10.4	Yes/No/NA
38	Lightning protection and insulation coordination comply with Ausgrid requirements.	10.4	Yes/No/NA
39	Auxiliary power supplies designed and installed in accordance with Ausgrid	10.5	Yes/No/NA

Item	Description	Refer Clause	Completed/ Actioned
	requirements.		
40	Nameplates and labelling comply with NS158 Labelling of Mains and Apparatus.	10.6	Yes/No/NA
41	All cabling works comply with the appropriate Ausgrid specification and standards.	10.7, 10.9, 10.10	Yes/No/NA
42	Secondary system design and installation complies with Ausgrid requirements.	11	Yes/No/NA
	Inspections, Commissioning, Documentation and Training		
43	Inspection and test plans prepared and undertaken in accordance with Ausgrid requirements.	12.1	Yes/No/NA
44	Test procedures prepared and submitted for Ausgrid approval.	12.2	Yes/No/NA
45	Completed certified type test reports obtained and submitted to Ausgrid.	12.3	Yes/No/NA
46	Commissioning plan prepared and followed.	13.0	Yes/No/NA
47	All documentation and drawings provided as required.	14.0	Yes/No/NA
48	A identified training requirements have been provided.	15.0	Yes/No/NA

Notes:

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The signatures panel of this document has been removed for privacy considerations. The remainder of the document is unchanged.